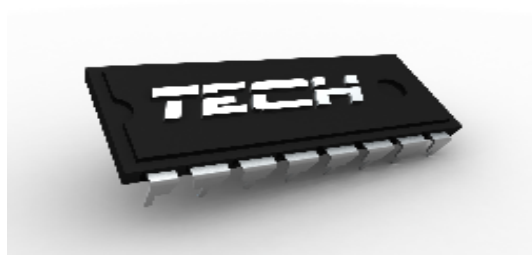


USER'S MANUAL **ST-402**



WWW.TECHSTEROWNIKI.PL

TECH



Declaration of Conformity No. 35/2010

Hereby, we declare under sole responsibility that the **ST-402** 230V 50Hz thermoregulator manufactured by TECH, ul. St. Batorego 14, 34-120 Andrychów, is compliant with the Regulation by the Ministry of Economy. (Journal of Laws Dz.U. 155 Item 1089) of July 21, 2007 implementing provisions of the Low Voltage Directive **(LVD) 2006/95/EC** of January 16, 2007.

The **ST-402** controller has been tested for electromagnetic compatibility (EMC) with optimal loads applied.

For compliance assessment, harmonized standards were used:

PN-EN 60730-2-9:2006.

Paweł Jura, Janusz Master



ATTENTION!

High voltage!

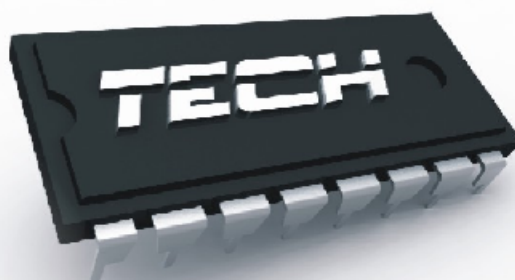
Make sure the regulator is disconnected from the mains before working on the power supply (cable connections, device installation, etc.)!

All connection works must only be carried out by qualified electricians.

Before activating the controller, measure the motor resetting efficiency and inspect wire insulation.



**THE DEVICE MAY BE DAMAGED
IF STRUCK BY A LIGHTNING.
MAKE SURE IT IS UNPLUGGED
DURING STORMS**



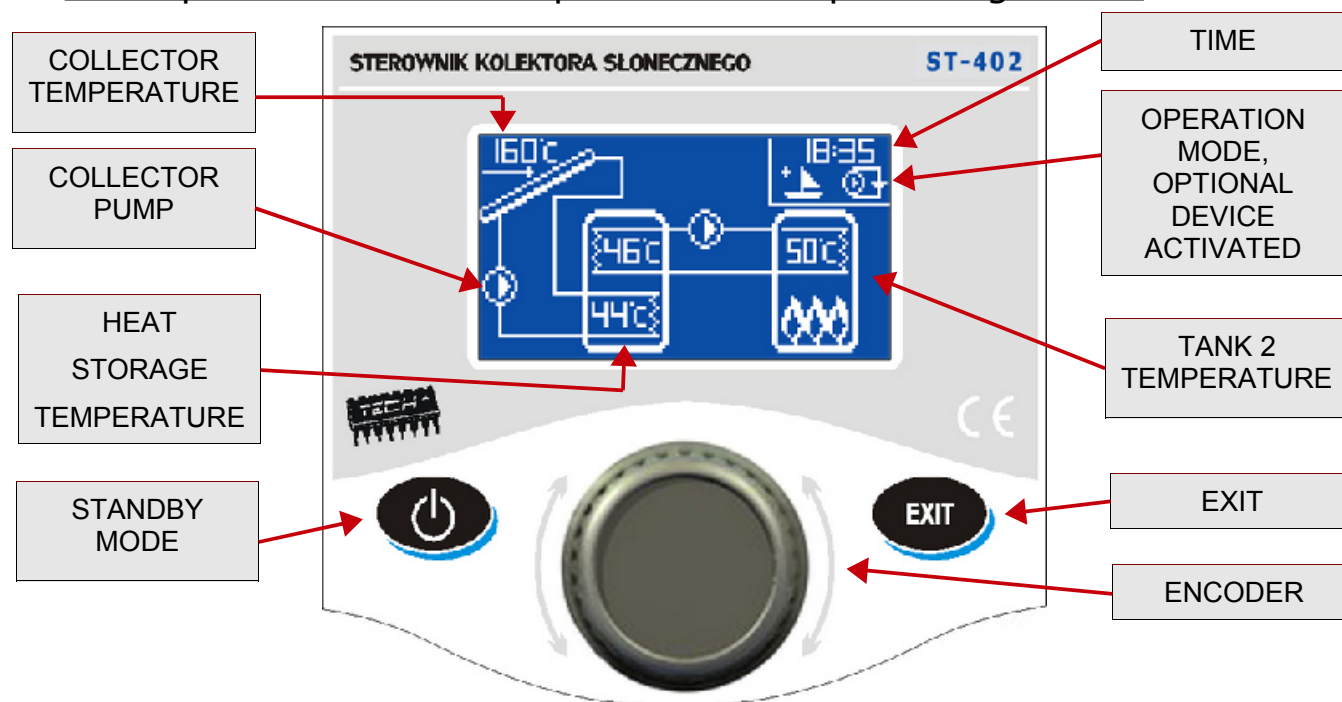
I. Intended Use

The ST-402 thermoregulator is intended for use with solar collectors in different configurations. The device is used to control collector pumps (or a pump and a valve) based on a temperature measurement at the solar batteries and at the accumulation tank (two tanks). It is also possible to connect optional devices: circulation pump, electric heater, or send a fire-up signal to the central heating boiler.

It is possible to control the circulation pump and input a fire-up signal into the central heating boiler directly from the controller. In case of the heater, it is required to fit an additional signal relay.

II. Principle of Operation

Description of the control panel in a sample configuration



The device is controlled with an encoder. By pressing the encoder knob, you can enter a menu or confirm settings. By turning the knob, you can navigate in menu functions. To go to the main page (or higher menu level), use the Exit button. All settings are changed in the same manner.

III. User's Menu

III.a) Main Page

During normal operation, the **graphic** display shows the *Main Page* that contains, apart from the selected configuration, the following information:

- operation mode (or type of alarm),
- current time,
- collector temperature,
- current heat storage temperature,
- temperatures of all additional sensors depending on configuration.

To the right of the screen, the following icons are displayed:

1. Icon of the active operation mode:



Automatic operation mode



Collector defrosting mode



Holiday mode



Collector overheating (alarm mode)



Sensor failure (alarm mode)

2. Icon of the active optional device (*peripherals*):




Circulation pump



PLT (pellet) boiler fire-up



Heater

When one of the sensors is damaged, an additional icon  starts to flash in the area where the temperature of the damaged sensor is normally displayed, to indicate which sensor has been disconnected or damaged.

In addition to the above, a pump icon (revolves if in operation) or/and valve icon (with an indication of the current circulation route) is displayed on the system configuration diagram.

III.b) Operation Mode

With this function, you can select an operation mode.

1. Automatic mode.

In the automatic mode, the pump is running if the minimum temperature difference between the collector and the tank is reached (the temperature difference at which the pump is started is defined by the "*Solar Pump Delta*" function in: *SERVICE MENU* > *Accumulation Tank* > *Solar Pump Delta*). The pump continues to run until the setpoint temperature is reached (the setpoint temperature is set with: *SERVICE MENU* > *Accumulation Tank* > *Setpoint Temperature*) or until the collector temperature and the tank temperature equalize (in which case the pump is restarted when the temperature at the collector rises above the tank temperature by the value of *solar pump delta*). Once the pump is shut off after the setpoint temperature has been reached, it will be restarted if the temperature drops below the setpoint value by the value of *tank hysteresis* (the hysteresis value is set with: *SERVICE MENU* > *Accumulation Tank* > *Storage Hysteresis*).

2. Collector Defrosting.

With this function, you can manually start the collector pump in order to melt snow built up on the solar panels. The mode remains active for a period defined by the user. Then the controller returns to

the automatic mode (the defrosting time is set with: *SERVICE MENU* > *Solar Collector* > *Defrosting Time*). The function can be deactivated manually by selecting another operation mode.

3. Holiday Mode.

When the holiday mode is enabled, during daytime hours (from 6⁰⁰ a.m. until 10⁰⁰ p.m.), the pump runs as in the automatic mode, whereas during night hours (from 10⁰⁰ p.m. until 6⁰⁰ a.m.), the pump is started only if the collector temperature is lower than the tank temperature so that the tank can be cooled.

ATTENTION >You can change the daytime cycle and night cycle activation hour using the "*DAY FROM*" and "*NIGHT FROM*" settings.<

4. Manual Mode.

In this function, the user can enable or disable (by pressing the encoder knob) the following:

- solar pump,
- second solar pump or switching valve,
- optional device (**voltage-free signal**, e.g. for firing up of a pellet boiler).

III.c) Clock

With this function, you can set the current time according to which the controller is to operate.

III.d) Day From

With this setting, you can define at what time the daytime mode is to be activated (*Day From Hour*).

III.d) Night From

With this setting, you can define at what time the night mode is to be activated (*Night From Hour*).

III.d) Language Version

You can select the language version for the controller.

III.e) Information

When this option is selected, the logo of the manufacturer is displayed together with the software version.

IV. Service Menu

To enter the service settings, select SERVICE MENU, then input 112 with the encoder and confirm the entry by pressing the knob. To return to the main page (exit the service menu), press EXIT twice or wait approx. 30 seconds (for the device to leave the service mode automatically).

IV.a) Accumulation Tank

With this menu, you can set all parameters associated with the tank (heat storage).

IV.a.1) Setpoint Temperature

This function is used to define the setpoint temperature at the storage that, if reached, will cause the collector pump to shut off.

IV.a.2) Maximum Temperature

With this option, you should define the highest permissible temperature value for the tank to reach in case *the collector is overheated*.

Should the collector reach the alarm temperature (*overheating*), the pump will be started automatically in order to cool the collector, regardless of the setpoint temperature. The pump continues to run until the *maximum storage temperature* is reached or until the collector temperature drops by the value of *alarm hysteresis* (see: *SERVICE MENU > Solar Collector > Alarm Hysteresis*).

IV.a.3) Storage Hysteresis

With this function, you can define the value of storage hysteresis. If the storage temperature reaches the setpoint value and the pump is shut off, the pump will be restarted after the storage temperature drops below the hysteresis value.

IV.a.4) Solar Pump Delta

This function is used to define the temperature difference between the collector and the tank at which the pump starts to run (pump activation threshold value).

IV.b) Solar Collector

With this menu, you can set all parameters associated with the solar collector.

IV.b.1) Maximum temperature

With this setting, you can define the maximum safe temperature of the collector. The value must be set according to technical data of the collector in use.

Should the maximum (alarm) temperature be reached, the controller will enter the *collector overheating mode*.

IV.b.2) Alarm Hysteresis

With this function, you can define the value of the collector alarm hysteresis. If the storage temperature reaches the alarm value (*collector overheating*) and the pump is started, the pump will be stopped again after the collector temperature drops below the *maximum temperature* by the hysteresis value.

IV.b.3) Defrosting Time

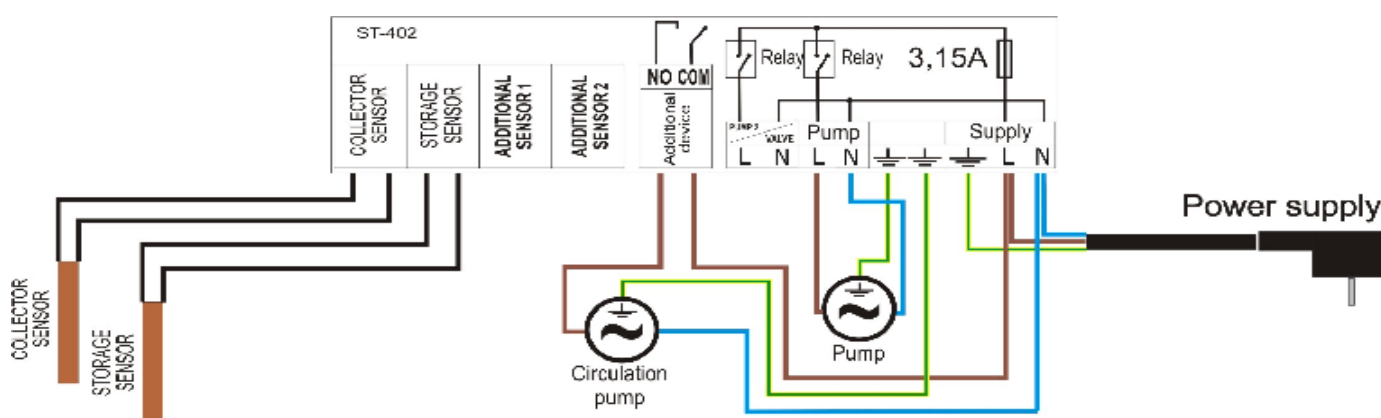
With this function you can define how long the pump is to run after the *boiler defrosting* function is activated.

IV.c) Peripherals

It is possible to connect and configure optional devices. If no optional device is connected, select *N/A* (disable). Below described are three available optional devices and their connections with all available system configurations.

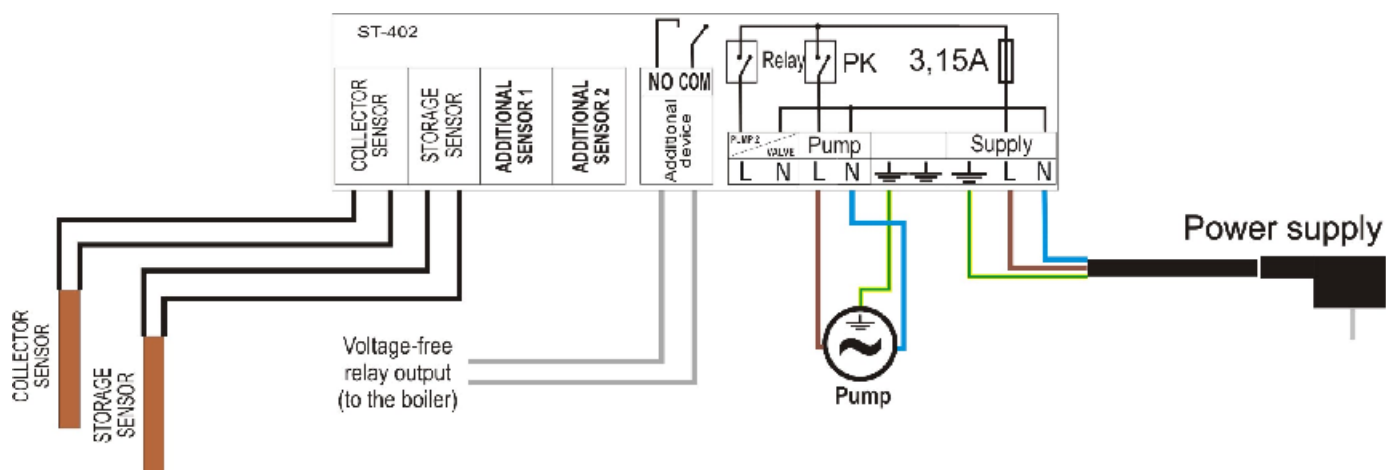
IV.c.1) Circulation Pump

Once the device is selected, set the periodical *duty time* and *pause time* for the pump during its activity hours. Then define periods in which the pump will be active using the "*From Hour*" and "*Until Hour*" functions. If the same time is entered ("*from - until*"), the device will run non-stop.



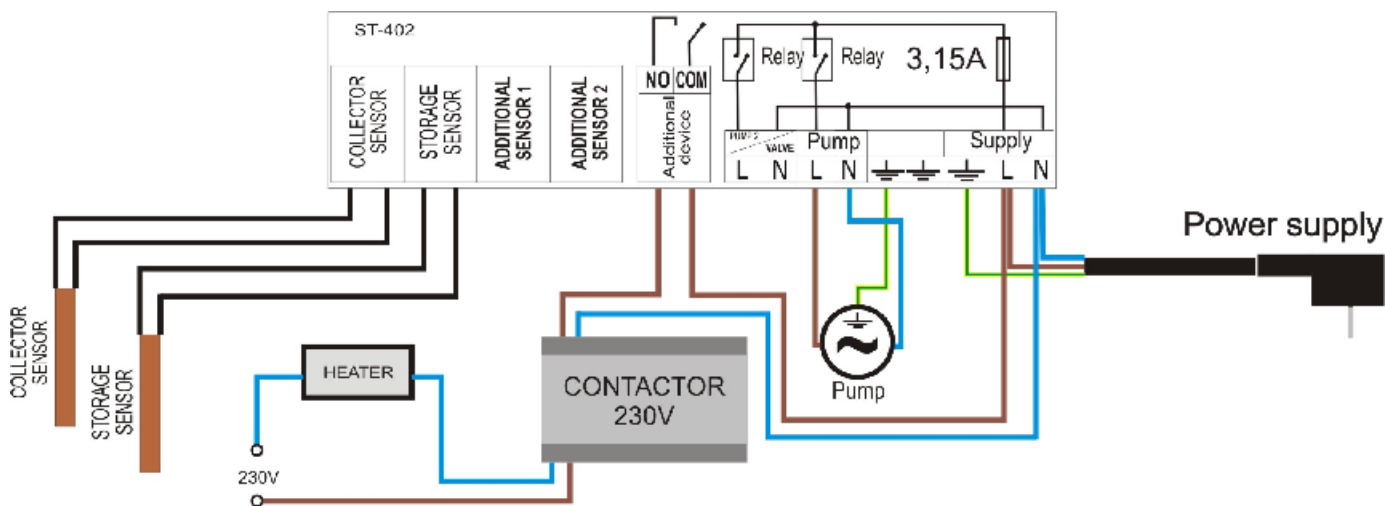
IV.c.2) PLT (Pellet) Boiler Fire-Up

With this option, you can set a voltage-free signal intended to fire up the pellet boiler. Set the *activation delta*, i.e. the difference between the setpoint temperature and actual temperature of the storage that, if reached, will cause the controller to send a signal to fire up the boiler. Then define a period in which the function will be active (using the "*From Hour*" and "*Until Hour*" functions).



IV.c.3) Heater

The heater is used to electrically heat the tank. The principle behind its operation is similar to one described in the previous case, although the heater is to be connected with an additional contactor. Set the activation delta (the difference between the setpoint temperature and actual temperature of the storage) below which the controller will start the heater. Then define a period in which the heating function will be active (using the "*From Hour*" and "*Until Hour*" functions).

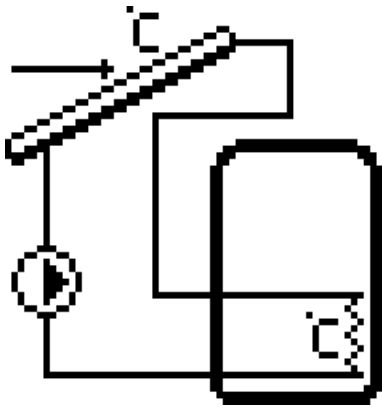


IV.d) Installation Diagram

For the solar system to work properly, it is essential to determine the right installation diagram (*SERVICE MENU > INSTALLATION DIAGRAM*) and to properly adjust the selected configuration (*SERVICE MENU > INSTALLATION OPTIONS*).

ATTENTION When selecting the installation diagram, the numbers of sensors are displayed in place of their temperature values. Sensors must be connected in the following order (starting from the left):

- | | |
|----------------------------|----------------------------|
| (1) – collector sensor, | (2) – storage sensor, |
| (3) – additional sensor 1, | (4) – additional sensor 2. |

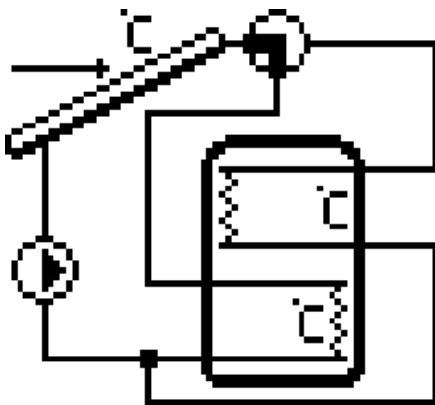
IV.d.1) 1/9 Diagram

The 1/9 diagram includes:

- collector pump,
- accumulation tank,
- a single arrangement of collectors,
- additional peripherals.

System sensors:

- collector sensor,
- accumulation tank sensor.

IV.d.2) 2/9 Diagram

The 2/9 diagram includes:

- collector pump,
- switching valve,
- accumulation tank,
- a single arrangement of collectors,
- additional peripherals.

System sensors:

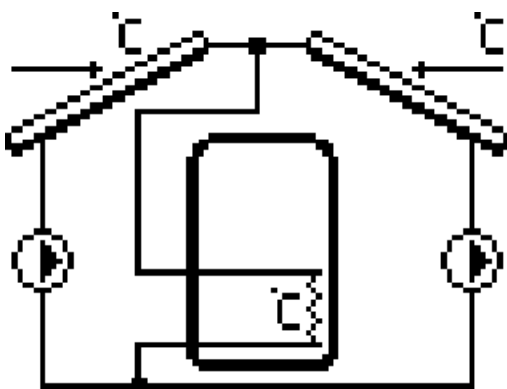
- collector sensor,
- two accumulation tank sensors.

Additional installation options:

- *valve hysteresis*

The tank is initially heated in its upper portion (from where hot consumption water is supplied), and when it has sufficiently been heated, the valve switches to the circuit of the other portion. The valve will switch back when the priority portion of the tank cools down by the value of *valve hysteresis* (i.e. the temperature difference between the two portions of the tank).

IV.d.3) 3/9 Diagram



The 3/9 diagram includes:

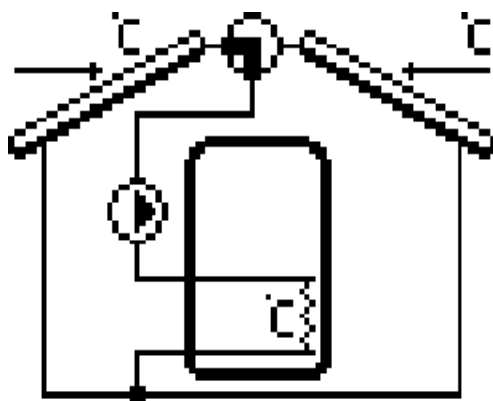
- two collector pumps (running independently, each according to its circuit),
- accumulation tank,
- two arrangements of collectors,
- additional peripherals.

System sensors:

- two collector sensors,
- accumulation tank sensor.

Attention. Solar collector settings (*SERVICE MENU* > *SOLAR COLLECTOR*) refer equally to collectors positioned in both directions.

IV.d.4) 4/9 Diagram



The 4/9 diagram includes:

- collector pump,
- switching valve,
- accumulation tank,
- two arrangements of collectors,
- additional peripherals.

System sensors:

- two collector sensors,
- accumulation tank sensor.

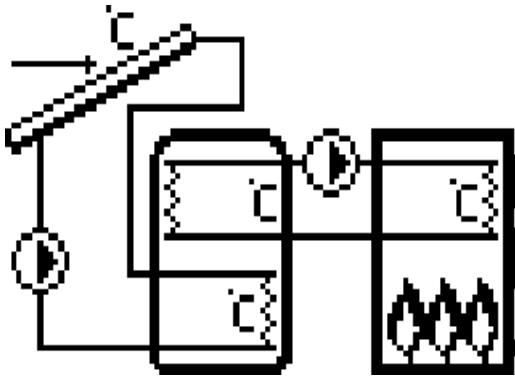
Additional installation options:

- *collector delta*

In this configuration, only one heating circuit is active. The switching valve is intended to switch the circuit to a collector the

temperature of which is currently higher at least by the value of *collector delta* (the temperature difference between the two collectors).

IV.d.5) 5/9 Diagram



The 5/9 diagram includes:

- collector pump,
- auxiliary pump (*pump 2*),
- accumulation tank,
- a single arrangement of collectors,
- additional peripherals.

System sensors:

- collector sensor,
- two accumulation tank KTY sensors,
- boiler temperature sensor.

Additional installation options:

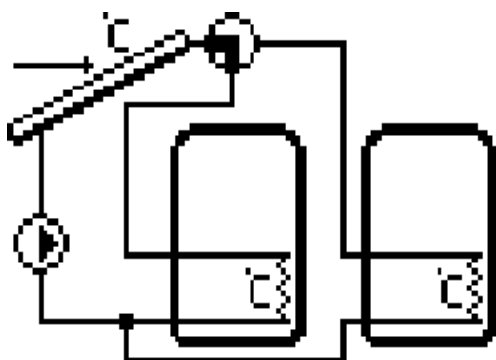
- activation delta

This configuration features an additional heating circuit to provide additional heating with the use of a central heating boiler. If the tank temperature is lower than the tank setpoint temperature at least by the setpoint value of *activation delta* (i.e. the difference between the setpoint temperature and the actual temperature of the tank), the auxiliary pump (from the boiler) is started in order to provide additional heating for the accumulation tank (providing that the boiler temperature is higher than the tank temperature). This setting is available only in periods defined by the user ("*from, until*").

- From Hour
- Until Hour

These settings are used to define periods ("*from, until*") in which the central heating boiler will provide additional heating for the accumulation tank.

IV.d.6) 6/9 Diagram



The 6/9 diagram includes:

- collector pump,
- switching valve,
- two accumulation tanks,
- a single arrangement of collectors,
- additional peripherals.

System sensors:

- collector sensor,
- accumulation tank sensors.

Additional installation options:

- tank 2 setpoint temperature

If the setpoint temperature for the first tank is reached, the valve will switch the supply to the second tank. With this function, you can set the *setpoint temperature* for the second tank.

- tank 2 hysteresis

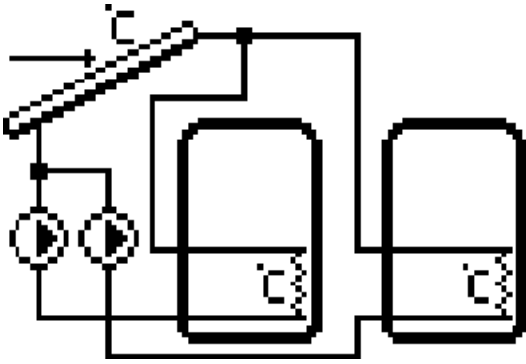
Once the setpoint temperature is reached, the pump is shut off. The pump will start again when the tank temperature drops below the setpoint value by the *tank 2 hysteresis*.

- valve hysteresis

This setting is used to adjust the valve when cooling the collector in the summer mode or alarm mode as well as during defrosting. The *valve hysteresis* defines the temperature difference between the tanks at which the valve is switched to the other tank.

- tank 2 maximum temperature

With this option, you should define the highest permissible temperature value for the second tank to reach in case *the collector is overheated*.

IV.d.7) 7/9 Diagram

The 7/9 diagram includes:

- two collector pumps,
- two accumulation tanks,
- a single arrangement of collectors,
- additional peripherals.

System sensors:

- collector sensor,
- accumulation tank sensors.

Additional installation options:

- tank 2 setpoint temperature

This function is used to define the setpoint temperature of the second tank that, if reached, will cause the collector pump 2 to stop.

- tank 2 hysteresis

Once the setpoint temperature is reached, the pump is shut off. The pump will start again when the tank temperature drops below the setpoint value by the *tank 2 hysteresis*.

- tank 2 maximum temperature

With this option, you should define the highest permissible temperature value for the second tank to reach in case *the collector is overheated*.

- pump 2 delta

This function is used to define the temperature difference between the collector and the second tank at which pump 2 starts to run (pump activation threshold value).

- operation algorithm

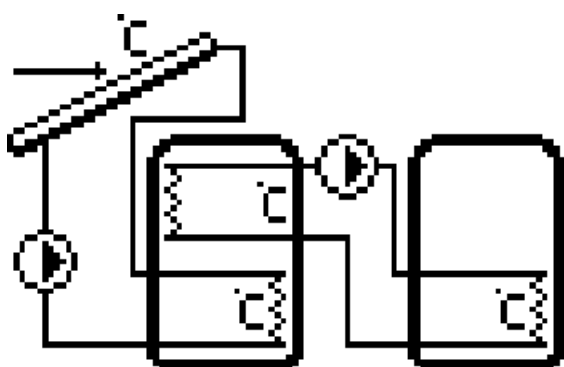
With this option, you can select operation modes for the pumps. The pumps can be operated in the following modes:

- a) *tank 1 priority* – initially, tank 1 is heated (only pump 1 is

running), and when the setpoint temperature is reached, pump 2 is activated to provide additional heating for tank 2.

b) parallel operation – the pumps are running independently, each in its own range (according to its settings), with both tanks being heated simultaneously.

IV.d.8) 8/9 Diagram



The 8/9 diagram includes:

- collector pump,
- tank 2 pump,
- two accumulation tanks,
- a single arrangement of collectors,
- additional peripherals.

System sensors:

- collector sensor,
- two sensors of the main accumulation tank,
- sensor of the additional accumulation tank.

Additional installation options:

- tank 2 setpoint temperature

This function is used to set the setpoint temperature of the second tank that, if reached, will cause the pump of tank 2 (*collector pump 2*) to stop.

- tank 2 hysteresis

Once the setpoint temperature is reached, pump 2 is shut off. Pump 2 will start again when the tank temperature drops below the setpoint value by the *tank 2 hysteresis*.

- pump 2 delta

This function is used to define the temperature difference between tank 1 and 2 at which pump 2 is activated (pump 2 activation threshold

value).

→ tank 2 maximum temperature

With this option, you should define the highest permissible temperature value for the second tank to reach in case *the collector is overheated*.

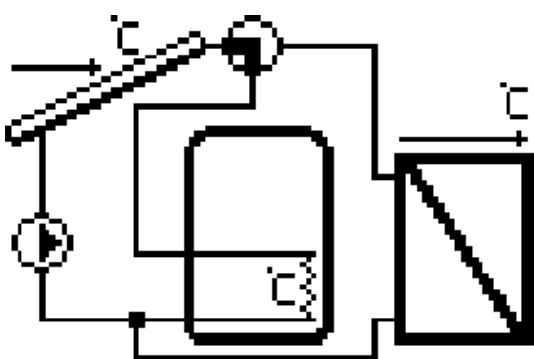
→ operation algorithm

With this option, you can select operation modes for the pumps. The pumps can be operated in the following modes:

a) *tank 1 priority* – initially, tank 1 is heated (only pump 1 is running), and when the setpoint temperature is reached, pump 2 is activated to provide additional heating for the other tank. Pump 2 is shut off when the setpoint temperature for the second tank is reached or when temperatures of both tanks equalize.

b) *parallel operation* – the pumps are running independently, each in its own range (according to its settings), with both tanks being heated simultaneously (in parallel).

IV.d.9) 9/9 Diagram



The 9/9 diagram includes:

- collector pump,
- switching valve,
- accumulation tank,
- heat exchanger (heat receiver),
- a single arrangement of collectors,
- additional peripherals.

System sensors:

- collector sensor,
- accumulation tank sensor.
- heat exchanger sensor.

Apart from the accumulation tank, the system features a heat receiver (e.g. a swimming pool or central heating system) intended to emit heat instead of accumulating it.

Additional installation options:

→ tank 2 setpoint temperature

This function is used to define the setpoint temperature at the second heat receiver (exchanger) that, if reached, will cause the collector pump to stop.

→ tank 2 hysteresis

Once the setpoint temperature at the receiver is reached, the pump is shut off. The pump will be restarted when the temperature of the heat receiver drops below the setpoint value by the value of *tank 2 hysteresis* (providing that tank 1 is well heated and the valve has not been switched to the accumulation tank).

→ valve hysteresis

If the setpoint temperature for the first tank is reached, the valve will supply the heat receiver. The valve will switch back when the first tank cools down by the value of *valve hysteresis* (i.e. the temperature difference between the two tanks).

→ tank 2 maximum temperature

With this option, you should define the highest permissible temperature value for the second tank (heat receiver) to reach in case *the collector is overheated*.



V. Standby Mode

When the *Standby Mode* button is pressed on the control panel, all actuators within the system are disabled. The button is used when the controller needs to be temporarily stopped.

VI. Protections


In order to ensure a safe and faultless operation, the regulator has been provided with numerous protections.

1. System sensor protections.

When one of the sensors is damaged, an acoustic warning is sounded, and to the right of the display, the following icon is shown:  An additional icon  starts to flash in the area where the temperature of the damaged sensor is normally displayed, to indicate which sensor has been disconnected or damaged.

In order to deactivate the alarm in the sensor failure mode, press the **EXIT** button.

2. Collector overheating protection.

Should the maximum (alarm) temperature be reached, the controller will enter the collector *overheating* mode, and in the display, the following icon is shown: . The pump starts to run in order to cool the collector until the *maximum storage temperature* is reached or until the collector temperature drops by the value of *alarm hysteresis* (see: *SERVICE MENU > Solar Collector > Alarm Hysteresis*). In case two tanks are available, both tanks are used to cool the overheated collector (simultaneously or consecutively, depending on the set operation algorithm).

3. Heat Storage Protection.

If the boiler is overheated, each tank can be heated up to the set safe

temperature threshold. Once this temperature is reached, the pump of the given tank is stopped (in the configuration of two tanks with a valve, the circuit of the second tank is enabled).

3. Fuse.

The regulator has a network protection WT 3.15A tube fuse.

ATTENTION: it is not advisable to use fuses with higher current ratings. Higher current ratings may cause damage to the controller.

VII. Maintenance

Before and during the heating season, the **ST-402** controller should be checked for condition of its cables. You should also check if the controller is properly mounted and clean it if dusty or dirty.

ST-402 Technical Specifications	
Supply voltage	230V/50Hz +/- 10%
Temperature adjustment range	8°C : 90°C
Power consumption	max. 4W
Collector sensor temperature resistance	-30°C : 180°C (momentarily 200°C)
Temperature resistance of the remaining sensors	-25°C : 100°C
Measurement accuracy	1°C
Ambient temperature	10°C : 50°C
Load on each output	1A
Fuse insert	3.15A



We are committed to protecting the environment. Manufacturing electronic devices imposes an obligation of providing for environmentally safe disposal of used electronic components and devices. Hence, we have been entered into a register kept by the Inspection For Environmental Protection. The crossed out bin symbol on a product means that the product may not be disposed of to household waste containers. Recycling of wastes helps to protect the environment. The user is obliged to transfer their used equipment to a collection point where all electric and electronic components will be recycled.

VIII. Assembly

ATTENTION: all assembly works must only be carried out by qualified persons. During assembly, the device must be disconnected (make sure the power cord is unplugged)!

Wire connections



Collector Installation Block Diagram

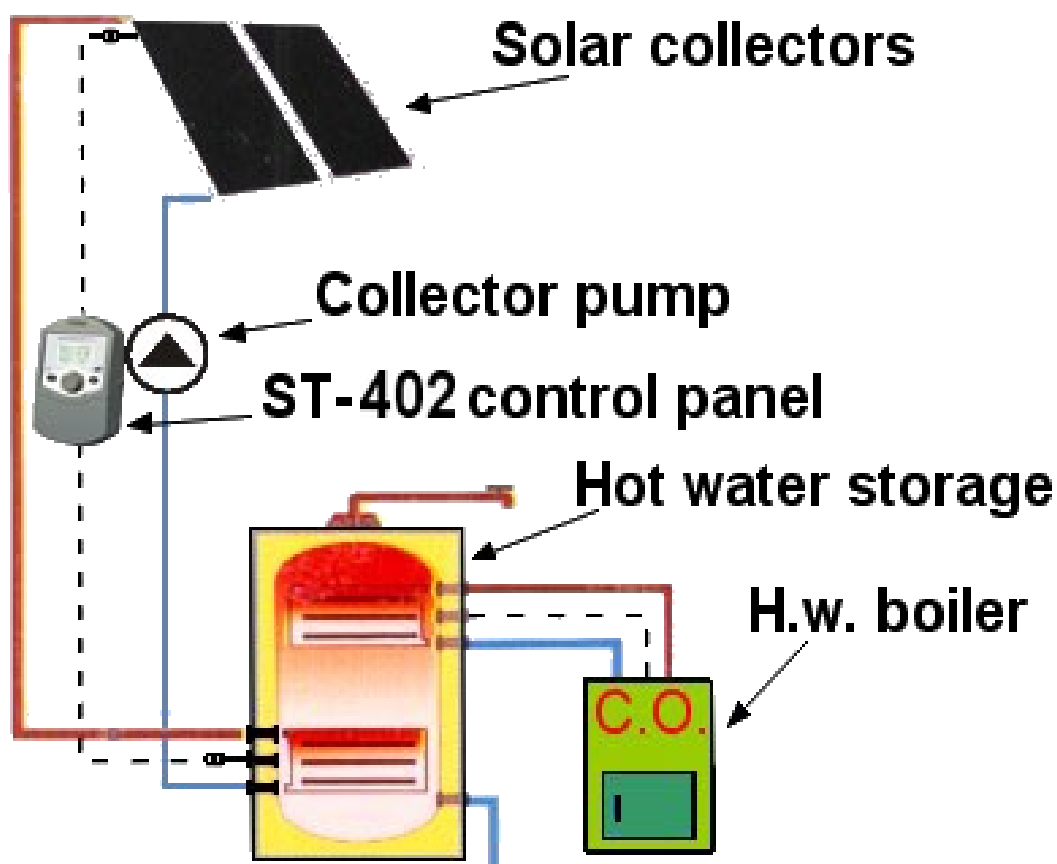
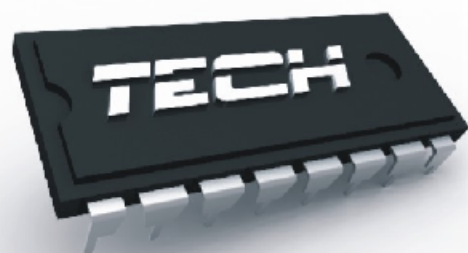


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All faults should be reported to:
Monday - Friday

7.00-16.00

Saturday

9.00-12.00